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Labour Market Effects of Supply Chain Bottlenecks

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Abstract

During the COVID-19 pandemic there were supply chain bottlenecks all over the world with regard to raw materials and intermediate products. In this article, we examine how these constraints affected labour market development. For an empirical panel analysis, we combine survey data and administrative labour market data for economic sectors in Germany. We find effects on unemployment that are noticeable but still relatively limited. The effect on short-time work, on the other hand, is revealed to be considerable. Whilst short-time work is traditionally imposed where there are slumps in demand, our results show that it is also used in the case of adverse supply shocks. While inflation is rising, this explains why the Phillips curve does not shift outward.

Zusammenfassung

Während der COVID-19-Pandemie kam es weltweit zu Lieferkettenengpässen bei Rohstoffen und Zwischenprodukten. In diesem Artikel untersuchen wir, wie sich diese Einschränkungen auf die Arbeitsmarktentwicklung ausgewirkt haben. Für eine empirische Panelanalyse kombinieren wir Befragungsdaten und administrative Arbeitsmarktdaten für Wirtschaftsbereiche in Deutschland. Wir finden spürbare, aber noch relativ begrenzte Auswirkungen auf die Arbeitslosigkeit. Die Auswirkung auf die Kurzarbeit erweist sich dagegen als erheblich. Während Kurzarbeit traditionell bei Nachfrageeinbrüchen verhängt wird, zeigen unsere Ergebnisse, dass sie auch bei negativen Angebotsschocks zum Einsatz kommt. Bei steigender Inflation erklärt dies auch, warum sich die Phillips-Kurve nicht nach außen verschiebt.

JEL classification

C23; E24; E31; J63; J64

Keywords

material shortages; supply chain; labour market; COVID-19 crisis; short-time work

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1 Introduction

The COVID-19 pandemic led to supply chain bottlenecks all over the world with regard to raw materials and intermediate products (e.g. Krolikowski/Naggert 2021). The Russia-Ukraine war is exacerbating this problem even further. In the literature, the topic of material shortages is not treated exhaustively, perhaps because considerable problems with the supply chain were a rare phenomenon themselves until recently (Wohlrabe 2021). However, the potential damage that such shortages can cause to the labour market and their relevance for the functioning of the economy are significant. To the best of our knowledge, this article is the first to demonstrate labour market effects of supply chain bottlenecks in the COVID-19 crisis.

We particularly examine how material shortages affect both short-time work and entries into and exits from unemployment. For an empirical panel analysis, we combine survey data and administrative labour market data for economic sectors in Germany. The results show that the effects of supply chain bottlenecks on unemployment are noticeable but still relatively limited. We do find a large effect on short-time work, however. Apparently, short-time work is used to cushion a temporarily lower demand for labour due to material shortages (e.g. due to production stoppages). While inflation is rising, this explains why the Phillips curve does not shift outward despite adverse supply shocks.

2 Data

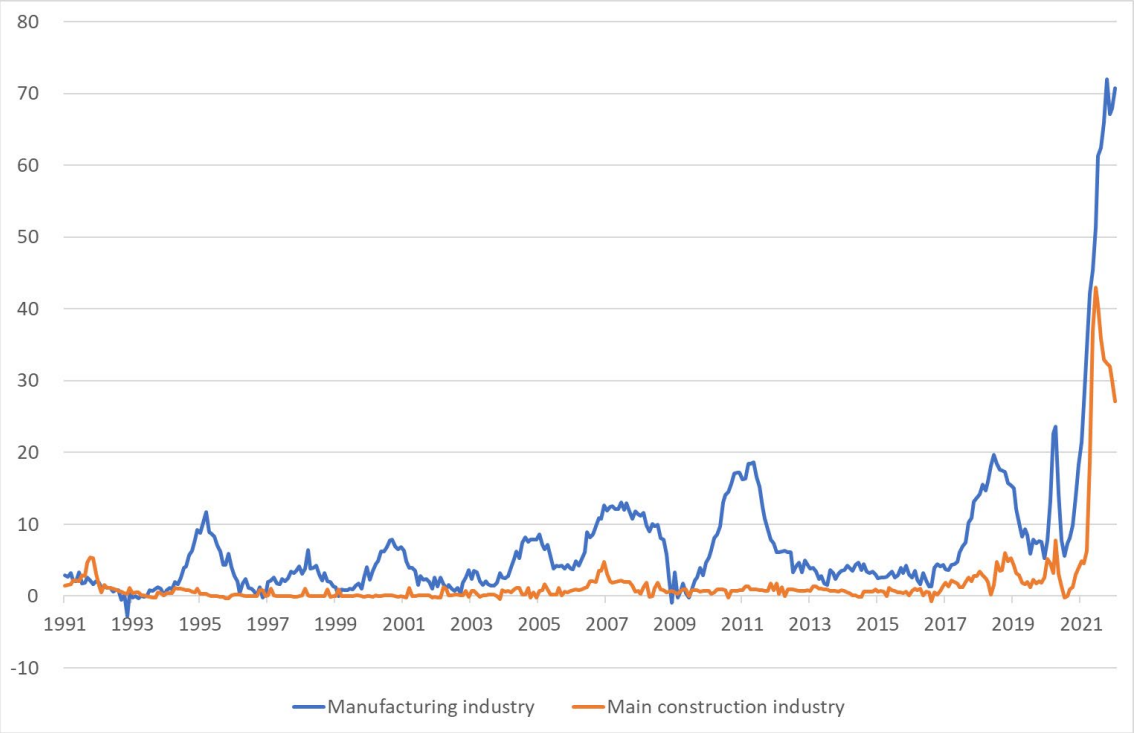
We use data from the Ifo Institute's surveys of the economic situation[1] to determine the extent of the material bottlenecks. Here, a quarterly survey is carried out to determine whether the production in the companies in the manufacturing industry is currently being hampered due to the lack of raw materials or semi-finished products (Wohlrabe 2021). The data includes 22 groupings of the manufacturing industry (sector C in the Industrial Classification 2008). Furthermore, we also draw on data from the Ifo Institute's monthly survey of the main construction industry (divided into structural and civil engineering), which enquires about current hindrances to construction due to material shortages or insufficient technical equipment.

We therefore have data for a total of 24 economic sectors. To obtain monthly time series, the quarterly material bottleneck variable is interpolated with the aid of the monthly variable for the estimation of inventory levels (likewise Ifo data) in accordance with the Chow-Lin method (1971). Table 2 (in the appendix) illustrates the average percentages of businesses that are affected by material bottlenecks for the period from April 2021 to January 2022, divided into economic sectors. Accordingly, it was the sectors involving mineral oil refining and electrical equipment manufacturing and, as a result of this, the areas concerning automotive and automotive parts manufacturing and other vehicle manufacturing which were particularly affected by the material shortage in that period.

[1] We would like to thank the Ifo Institute for providing the data.

Figure 1 shows how the material bottlenecks have developed over time. It becomes clear that a bottleneck situation of this nature is without equal in the past 30 years. The share of businesses in the manufacturing industry whose production has been hampered by material bottlenecks reached an all-time high in October 2021 and has persistently remained at around the 70 percent mark since then. It is only in the main construction industry that the situation can be observed to have eased to some extent since it reached its peak in June 2021.

Figure 1: Share of businesses with material bottlenecks, January 1991 to January 2022 (in percent)

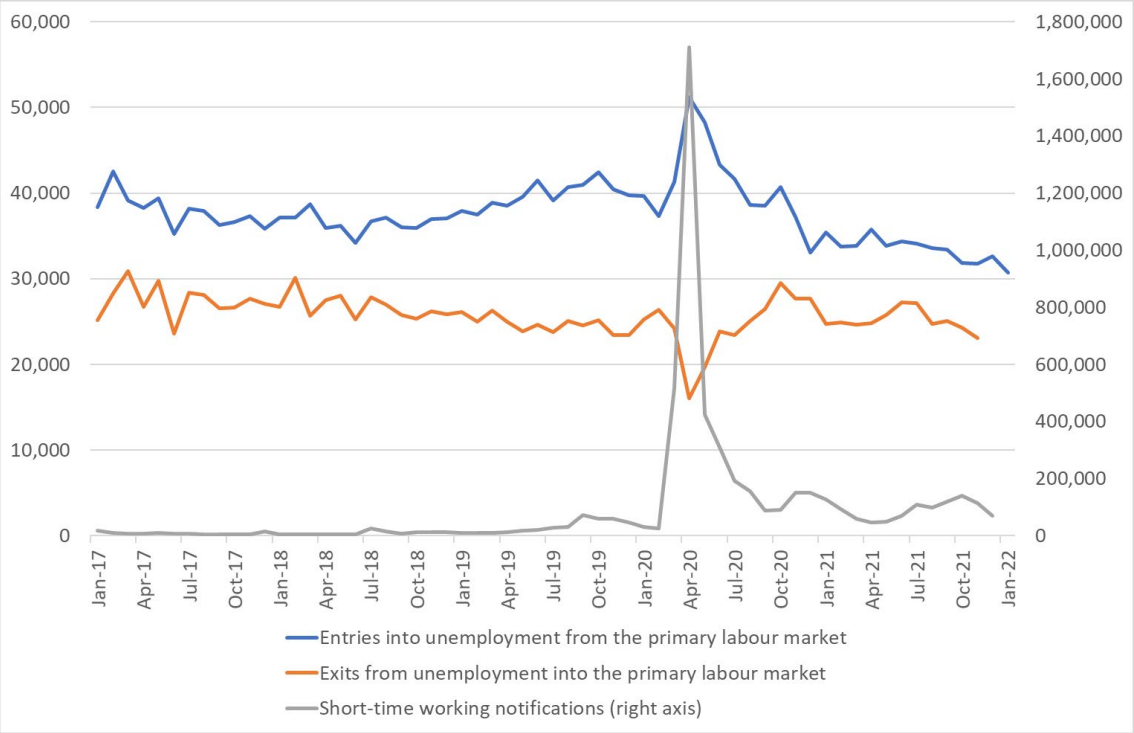


Source: Ifo surveys of the economic situation. © IAB

We obtain various variables from the German Federal Employment Agency statistics that have the same distinction according to economic sector and are seasonally adjusted in long time series. We use data on entries into unemployment from the primary labour market, exits from unemployment into the primary labour market and short-time work notifications[2]. Figure 2 shows the course across all sectors used here over time.

[2] Before short-time work can begin, a notification is required. In the case of reduced working hours in the form of short-time work, the employees receive pro-rata wage replacement benefits from the unemployment insurance system.

Figure 2: Course of seasonally adjusted labour market variables for the manufacturing industry and the construction industry in number of persons (January 2017 to January 2022)



Source: German Federal Employment Agency statistics and authors' calculations. © IAB

3 Method

We use the panel dimension across different sectors to estimate the effects of material bottlenecks on the labour market. The entries into unemployment, exits from unemployment and the short-time work notifications serve as independent variables, all of them logarithmised. We use time fixed effects to control macroeconomic influences like the economic situation, uncertainty or inflation. Sectoral level effects cancel out due to the application of orthogonal deviations (Arellano/Bover 1995). A dynamic panel model with a lagged endogenous variable is estimated by GMM. The share of firms subject to material bottlenecks which was calculated from the Ifo surveys is included as an explanatory variable, lagged if the explanatory power is improved. In addition, we control for the sector-specific production (obtained from destatis), thereby taking into account the fact that both the estimation of shortages and the labour market results may depend on the business activity.

The panel model is shown in equation (1):

$$y_{it} = c_1 + c_2 y_{it-1} + c_3 short_{it-j} + c_4 prod_{it-j} + \gamma_t + \varepsilon_{it}, \qquad (1)$$

where c_1 to c_4 represent the coefficients, y is the relevant labour market variable, $short$ the shortage indicator, $prod$ the industrial production, γ_t the time fixed effects and ε_{it} the error

terms. The sector index is denoted by $i = 1, \ldots, 26$, the time index by $t = 1, \ldots, 10$ and a potential lag by j.

Two further lags of y_{it-1} are used as instruments. The estimation period begins in April 2021 at the end of the second lockdown in Germany and ends in January 2022. We focus on the most recent phase of extreme material bottlenecks which bears no comparison to the previous course over time (see Figure 1). There are therefore a total of 240 observations available across the time and sector dimensions.

4 Results

Table 1 shows the estimated effects of the material shortage indicator on the three labour market dimensions.

Table 1: Effects of the material shortage indicator on labour market dimensions (in percent)

Entries into unemployment	Exits from unemployment	Short-time work notifications
0.88 (4.92)	-0.73 (-3.33)	3.01 (2.61)

Note: t-values in brackets (White cross-sectional clustered standard error)
Source: Own calculations. © IAB

There are statistically significant effects shown on all of the labour market variables observed. One point more in the shortage indicator increases the entries into unemployment by 0.88 percent and reduces the exits from unemployment by 0.73 percent. The effect on short-time work notifications is greater, at +3.01 percent. Regarding exits from unemployment and short-time work notifications, the significant effects are seen in the same month, while for entries into unemployment there is a lag of one month. Short-time work can be imposed very quickly, whilst it generally takes longer to end employment relationships in the German institutional context.

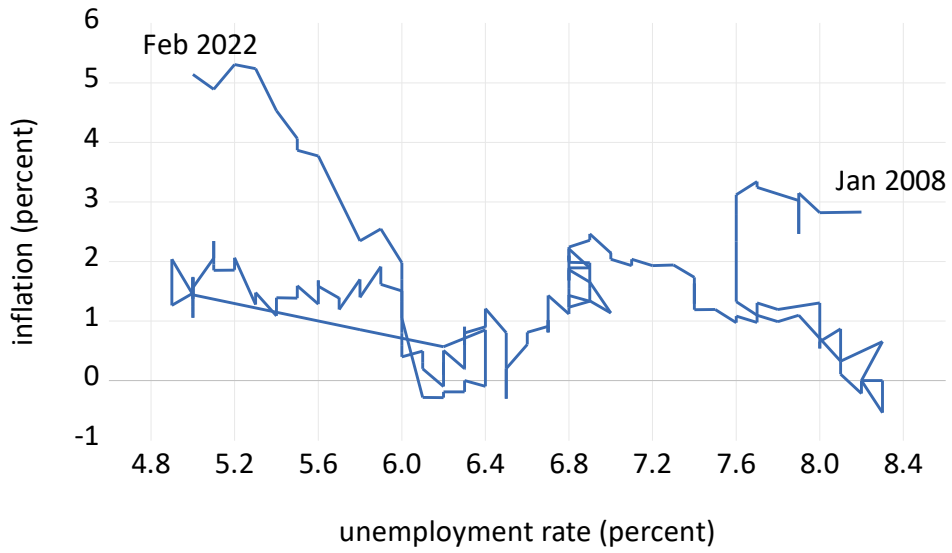
The overall effects over the estimation period can be identified in a counterfactual scenario. To do this we calculate a hypothetical development whereby the material bottlenecks would not have been exacerbated since April 2021. The differences in the bottleneck indicator can be applied to the estimated percentage labour market effects from Table 1 (per point in the indicator). As a result, for all of the industries observed, if the bottlenecks had not been exacerbated until January 2022, the percentage of entries into unemployment would have been 21 percent (or 47,000) lower, the exits from unemployment 17 percent (or 29,000) higher and the short-time work notifications 71 percent (or 446,000) lower.

Adverse supply shocks like those caused by material shortages are typically accompanied by higher inflation and higher unemployment and thus an outward shift of the Phillips curve. While inflation is indeed rising, it seems to move along the curve in Figure 3, which is typical for positive demand shocks. The slope of the current Phillips curve strongly resembles that observed during the upturn following the Great Recession. While Del Negro et al. (2020) found that changes in the Phillips curve before the COVID-19 pandemic were due to a muted reaction of inflation to cost

pressures, inflation is now rising strongly (compare Attinasi et al. 2021). However, increases in unemployment do not seem to happen in the face of adverse supply shocks.

Indeed, according to our results, unemployment is decoupled from the adverse supply shock to a large extent due to the use of short-time work. This largely prevents an outward shift in the inflation–unemployment diagram since unemployment does not mirror the whole slack in the labour market.

Figure 3: The Phillips curve in Germany since January 2008



Note: The figure shows the Phillips curve in Germany since January 2008.
Source: destatis, German Federal Employment Agency statistics. © IAB

We carry out various robustness checks in the panel models. In the models for the short-time work notifications and the exits from unemployment, the material bottlenecks exert effects within the contemporaneous month. As a robustness check, we instrument these with their first lag. Here, the variable remains significant even if the coefficients become slightly smaller.

Furthermore, we dispense with production as a control variable. This does not lead to strong changes in the results of the estimation. In a further robustness check, we consider input-output linkages between the sectors. While each sector is directly hit by its own bottlenecks, those in other sectors could lead to reduced demand due to dampened economic activity (Guerrieri et al. 2022). To account for this, we premultiply the vector of bottlenecks by an input-output matrix (obtained from the destatis National Accounts) and repeat the regression with the new variable. This only results in small changes.

5 Conclusion

For an empirical analysis of the effects of supply bottlenecks, we combine survey data and administrative labour market data for sectors in Germany. We quantify effects on the labour market in a panel setting.

The effects on unemployment are noticeable but still relatively limited. This is consistent with the finding that the development of employment in Germany has become less dependent on economic fluctuations (Klinger/Weber 2020). The effect on the short-time work notifications, on the other hand, is considerable. It is evidently short-time work that is predominantly used in order to adjust to the material bottlenecks. This follows the general pattern that has emerged from the COVID-19 crisis in both Germany (Gehrke/Weber 2020) and Europe (e.g. Giupponi et al. 2022).

Whilst short-time work is traditionally adopted when there are slumps in demand, our results show that it is also used in the case of supply shocks. With regard to hampering structural change this is usually viewed critically (see Giupponi et al. 2022), but in the case of exogenous and temporary shocks, short-time work is an effective means of stabilising employment until the business activity can recommence or be reframed.

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Appendix

Table 2: Share of businesses with material bottlenecks by sector in percent (average for April 2021 to January 2022)

Manufacturing industry	61.6
including:	
Manufacturing of food and feed	37.3
Beverage manufacturing	17.0
Textile manufacturing	49.6
Clothing manufacturing	41.4
Leather, leather goods and footwear manufacturing	46.1
Manufacturing of wooden, cane, wicker and cork products	44.5
Manufacturing of paper, cardboard and goods made of these	50.8
Manufacturing of print products; reproduction of recorded sound, image and data storage media	57.3
Mineral oil refining	93.5
Manufacturing of chemical products	53.5
Manufacturing of pharmaceutical products	30.3
Manufacturing of rubber and plastic goods	73.6
Manufacturing of glass and glassware, ceramics, non-metallic mineral processing	36.3
Metal production and metal working	33.8
Metal product manufacturing	61.8
Manufacturing of DV equipment, electronic and optical devices	72.8
Electrical equipment manufacturing	81.8
Mechanical engineering	68.6
Automotive and automotive parts manufacturing	78.6
Other vehicle manufacturing	80.5
Furniture manufacturing	67.3
Manufacturing of other goods	40.5
Main construction industry overall	32.9
including:	
Structural engineering	37.1
Civil engineering overall	27.3

Source: Ifo surveys of the economic situation and authors' calculations. © IAB

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